

Final Exam Instructions

- Answer Question 2 on the routing tables sheet.
- Answer Questions 1, 3, 4, and 5 on the **yellow paper**.
- Please use only **ONE SIDE** of the **yellow paper**.
- Please answer **ONE QUESTION** per page of **yellow paper**. If you need more than one page per question, use another sheet of **yellow paper**.
- Write your **NAME** and **VERSION** number on the routing tables sheet and the all **yellow paper**.
- Please hand in all materials in the correct order.

Version 1

1. (25 Points) Given that a frame is formatted as follows:

Destination Hardware Address	Source Hardware Address	Frame Type	Frame Data
6 Bytes	6 Bytes	2 Bytes	46 - 1500 Bytes

And given that a datagram is formatted as follows:

Byte	0							1							2							3										
bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Version			Header Length				Type Of Service							Total Length																	
4	Identification											Flags		Fragment Offset																		
8	TTL				Type				Header Checksum																							
12	Source IP Address																															
16	Destination IP Address																															
Optional	IP Options (May Be Omitted)														Padding																	
20	IP Payload Data																															

And given that a TCP segment is formatted as follows:

Byte	0							1							2							3										
bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Source Port											Destination Port																				
4	Sequence Number																															
8	Acknowledgment Number (If ACK is set)																															
12	Data Offset	Reserved		N S	C W R	E C R	U R E	A R G	P C K	R S H	S T N	F I N	Window Size																			
16	Checksum											Urgent Pointer (If URG is set)																				
Optional	TCP Options (May Be Omitted)														Padding																	
20	TCP Payload Data																															

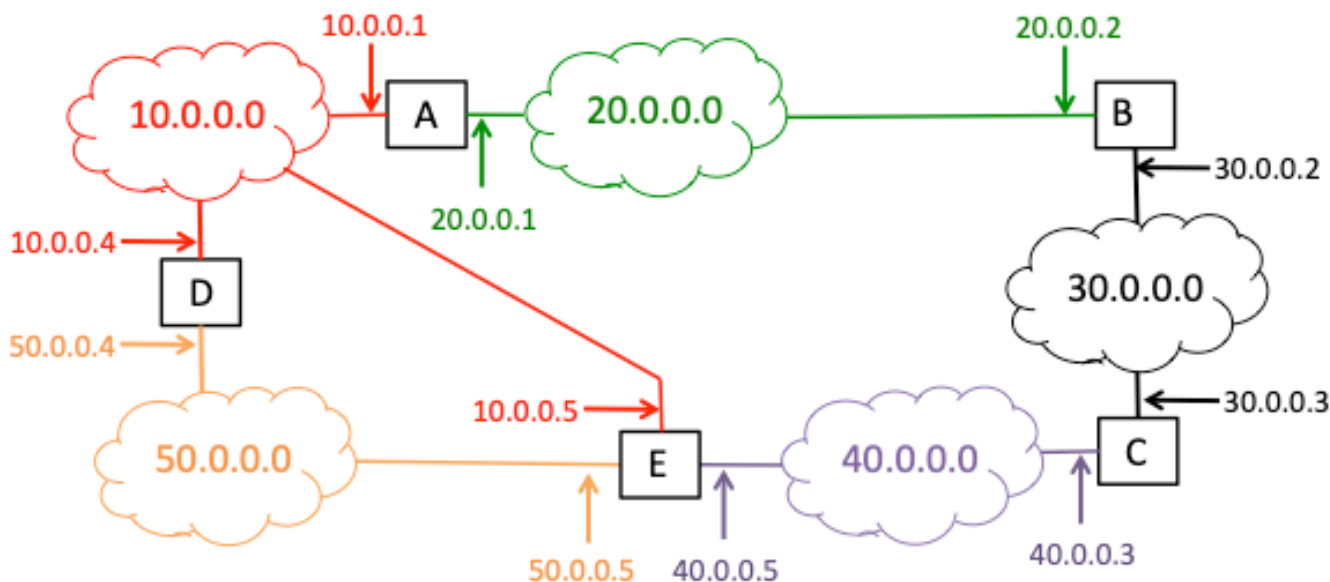
Assuming no options are present in the IP header and TCP header, And given the following frame with an encapsulated IP datagram and TCP segment:

92	11	D8	2D	73	7B	83	EE	17	C5	B7	5D	08	00	45	33
00	72	13	D5	69	73	8B	1A	61	50	7A	5E	D9	33	93	06
AC	D8	39	E1	CC	DD	D9	21	7A	B9	FC	84	2D	77	EC	F2
8F	44	87	9D	78	2A	20	29	C0	4D	F6	79	33	D2	B6	1A
62	74	3B	D4	F6	2E	DF	8C	37	15	56	9C	2A	36	8C	51
B4	25	5F	A4	53	B2	C1	26	82	6E	06	93	0A	E2	56	AC
C2	44	5B	DB	5C	CC	4A	A2	A2	2E	B4	B3	4D	1B	3E	BE
A0	99	D0	2C	1C	65	A4	B8	EA	88	3D	25	5F	5C	9A	33

Version 1

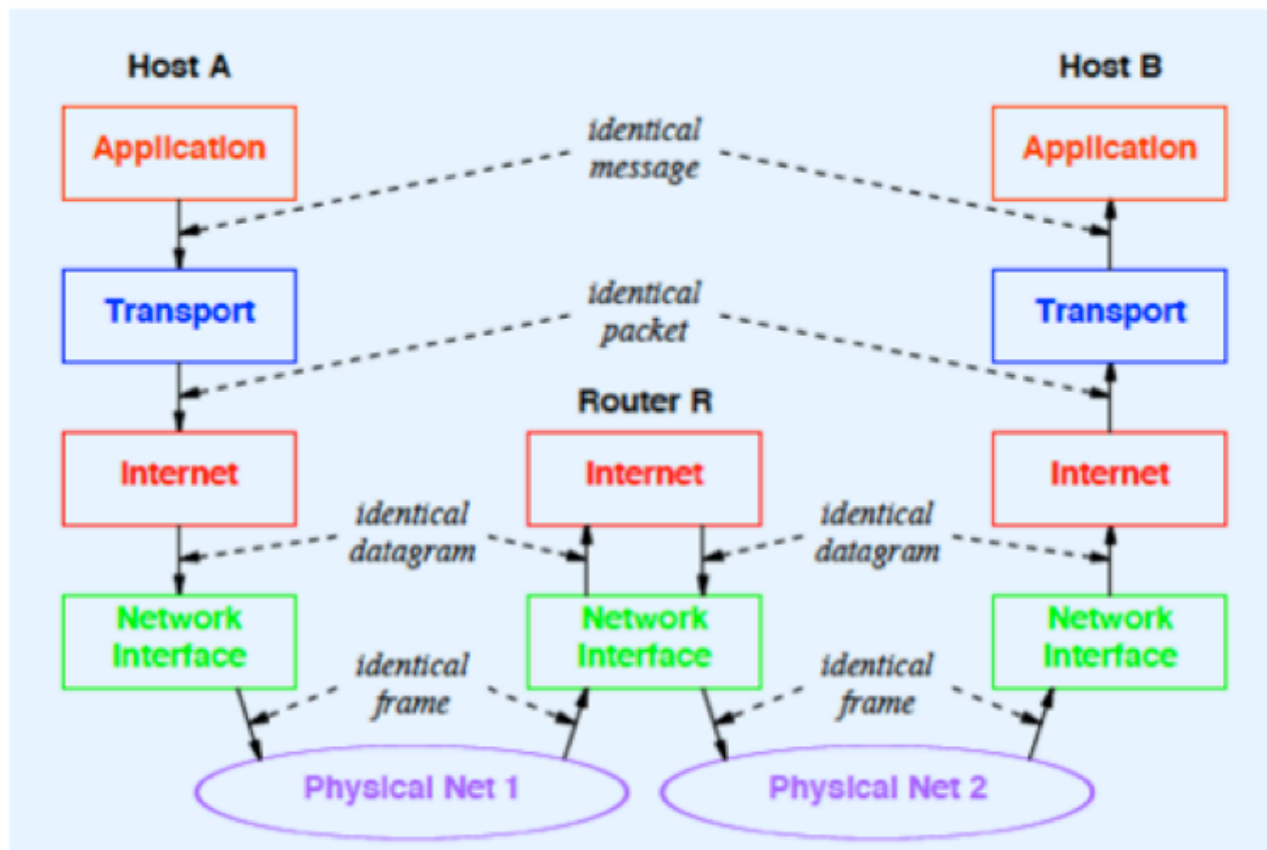
- a. Find the source hardware address
- b. Find the destination hardware address
- c. What type of frame is this?
- d. What is the Type Of Service in the IP Header?
- e. What is the fragment offset?
- f. What is the TTL count?
- g. Find the destination IP address
- h. What class is the destination IP address?
- i. What is the network ID in the destination address?
- j. What is the host ID in the destination address?
- k. Write the destination IP address in dotted decimal notation.
- l. Find the IP Header Checksum
- m. Find the source IP address
- n. What class is the source IP address?
- o. What is the network ID in the source address?
- p. What is the host ID in the source address?
- q. Write the source IP address in dotted decimal notation.
- r. Find the destination port.
- s. Find the source port.
- t. Find the acknowledgment number.
- u. Find the sequence number.
- v. What flags are set in the TCP header?
- w. Find the TCP segment checksum.
- x. Find the TCP window size.
- y. What are the first 5 bytes of data encapsulated inside the TCP segment?

2. (25 Points) Each router in the autonomous system shown below starts with a routing table showing the networks that they are directly connected to. The routers exchange routing information using a distance vector protocol. Show the messages that are exchanged and the state of the routing tables after each message. Use the Routing Tables sheet(s). **Please note that a broadcast to network 10.0.0.0 will result in more than one router receiving the message. Example E/T0 – A/T0 & D/T0.**



Version 1

3. (20 Points) Consider a fixed subnet partition of the class A network 123.0.0.0.
- (5 Points) How many bits will be necessary to divide the network into 8,100 subnets?
 - (5 Points) What is the maximum number of hosts each subnet can have?
 - (5 Points) What is the subnet mask in dotted decimal notation?
 - (5 Points) Write the dotted decimal IP address of subnet 7,589, host 1,937.
4. (20 Points) Given the IP address 187.211.229.189 and the subnet mask of 255.255.240.0.
- (10 Points) What is the network number?
 - (5 Points) What is the subnet number?
 - (5 Points) What is the host number?
5. (20 Points) The TCP/IP layering architecture is shown in the following figure. **Explain the entire message life cycle for a message originating from an application on Host A to an application on Host B.** Are the frames and datagrams identical on both sides of Router R? Why or why not?



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Version 2

1. (25 Points) Given that a frame is formatted as follows:

Destination Hardware Address	Source Hardware Address	Frame Type	Frame Data
6 Bytes	6 Bytes	2 Bytes	46 - 1500 Bytes

And given that a datagram is formatted as follows:

Byte	0							1							2							3										
bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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12	Source IP Address																															
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Optional	IP Options (May Be Omitted)														Padding																	
20	IP Payload Data																															

And given that a TCP segment is formatted as follows:

Byte	0							1							2							3										
bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Source Port							Destination Port																								
4	Sequence Number																															
8	Acknowledgment Number (If ACK is set)																															
12	Data Offset	Reserved	N S	C W R	E C R	U R E	A R G	P C K	S H	R T	S Y N	F I N	Window Size																			
16	Checksum							Urgent Pointer (If URG is set)																								
Optional	TCP Options (May Be Omitted)														Padding																	
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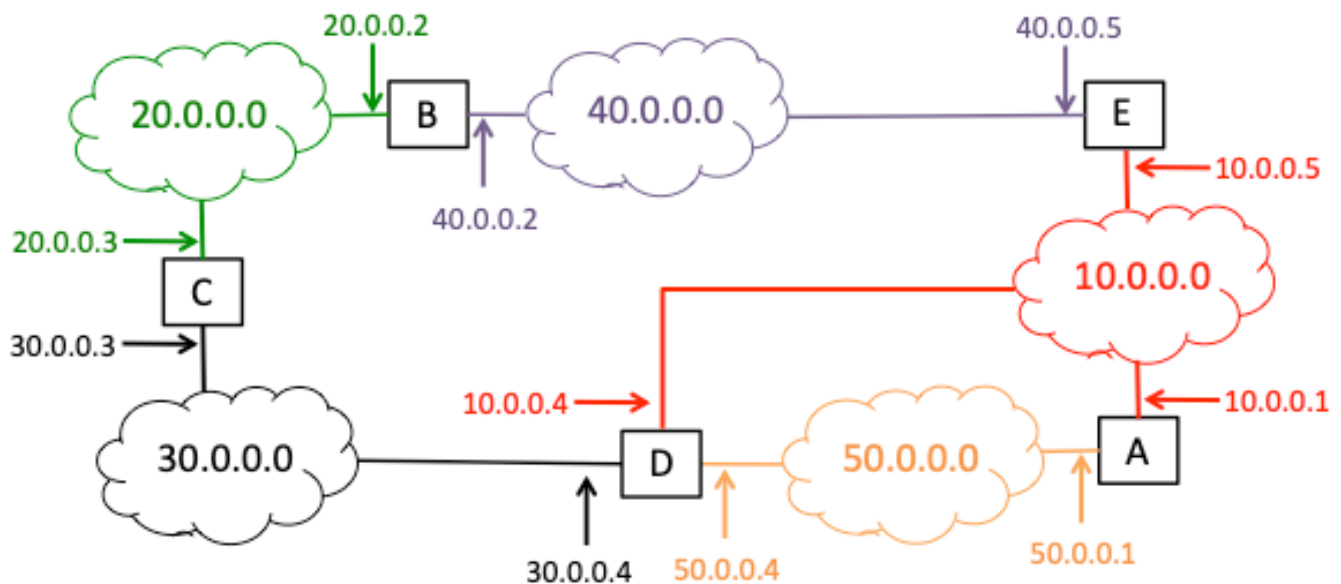
Assuming no options are present in the IP header and TCP header, And given the following frame with an encapsulated IP datagram and TCP segment:

18	56	B4	6D	CB	A8	C6	60	48	92	F3	62	08	00	45	CB
00	72	03	84	70	F1	6A	6B	76	08	07	57	AB	35	D4	6D
6E	9B	76	2F	98	07	7C	96	15	32	7C	9A	D7	38	B9	F0
77	76	E7	1B	C9	D6	A1	3E	0F	61	AF	33	BD	47	F0	2F
82	C6	C0	59	3C	CE	38	20	D1	19	D2	DD	1F	69	F7	91
85	49	3E	8E	F9	AF	06	91	23	BB	5D	7B	E1	A2	0F	D2
3D	BB	61	38	B1	28	9C	7D	AB	2E	20	24	98	79	B7	83
51	C1	C6	8B	74	EC	E1	77	E2	41	96	CD	8F	25	33	EF

Version 2

- a. Find the source hardware address
- b. Find the destination hardware address
- c. What type of frame is this?
- d. What is the Type Of Service in the IP Header?
- e. What is the fragment offset?
- f. What is the TTL count?
- g. Find the destination IP address
- h. What class is the destination IP address?
- i. What is the network ID in the destination address?
- j. What is the host ID in the destination address?
- k. Write the destination IP address in dotted decimal notation.
- l. Find the IP Header Checksum
- m. Find the source IP address
- n. What class is the source IP address?
- o. What is the network ID in the source address?
- p. What is the host ID in the source address?
- q. Write the source IP address in dotted decimal notation.
- r. Find the destination port.
- s. Find the source port.
- t. Find the acknowledgment number.
- u. Find the sequence number.
- v. What flags are set in the TCP header?
- w. Find the TCP segment checksum.
- x. Find the TCP window size.
- y. What are the first 5 bytes of data encapsulated inside the TCP segment?

2. (25 Points) Each router in the autonomous system shown below starts with a routing table showing the networks that they are directly connected to. The routers exchange routing information using a distance vector protocol. Show the messages that are exchanged and the state of the routing tables after each message. Use the Routing Tables sheet(s). **Please note that a broadcast to network 10.0.0.0 will result in more than one router receiving the message. Example E/T0 – A/T0 & D/T0.**



Version 2

3. (20 Points) Consider a fixed subnet partition of the class A network 115.0.0.0.
- (5 Points) How many bits will be necessary to divide the network into 8,050 subnets?
 - (5 Points) What is the maximum number of hosts each subnet can have?
 - (5 Points) What is the subnet mask in dotted decimal notation?
 - (5 Points) Write the dotted decimal IP address of subnet 7,719 host 1,899.
4. (20 Points) Given the IP address 181.235.229.241 and the subnet mask of 255.255.240.0.
- (10 Points) What is the network number?
 - (5 Points) What is the subnet number?
 - (5 Points) What is the host number?
5. (20 Points) The TCP/IP layering architecture is shown in the following figure. **Explain the entire message life cycle for a message originating from an application on Host A to an application on Host B.** Are the frames and datagrams identical on both sides of Router R? Why or why not?

